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ARE THE CANADIAN FORESTS BEING EXHAUSTED?

For some years past the belief has been gradually forming in the minds of those interested in the welfare of Canada that the forests of that country are being slowly but steadily used up; and the matter being one that has most serious aspects, it has been made the subject of an official inquiry, in order that the nature of the causes which may be at work in bringing about a destruction which is greater than the production of trees, might be ascertained, and remedies for so dangerous a state of things suggested. At the instigation of the Marquis of Lansdowne, the Governor-general of Canada, and with the concurrence of Lord Derby, an official communication was on the 2d of July, 1884, sent to the lieutenant-governors of the various provinces of the Dominion, asking for such information as was obtainable on the reported proximate exhaustion of forests. The replies received throw much light upon the subject.

Let us first deal with the small province of Prince Edward Island. The answer sent to Lord Lansdowne by the lieutenant-governor was brief, but very significant. He said that there were now no forests of any extent in the province, they having disappeared under the axes of the settler and the lumber-man.

From Nova Scotia, two Reports were received—one from the present, and the other from the former, Deputy-commissioner of Crown Lands. The former said that, having made inquiries of several gentlemen engaged in the lumbering business in the province, he had found that all, or nearly all, the timber-lands would have been cut over before the expiration of six years from the date of writing; though it did not follow that the timber-supply would then be exhausted. It was found that by carefully husbanding those trees which were too small for conversion into lumber at the time of the first cutting, a second cutting of nearly equal worth could, after fifteen or twenty years, be obtained in many localities; and that, consequently, if it were not for forest fires, those lands which were carefully looked after would never become denuded of their trees. It was true, however, that the supply of pine and spruce was rapidly being exhausted, and that the lumbering interests of the province were becoming of less importance every year. There was a considerable quantity of hemlock spruce in the province, but in many sections of the country it was being rapidly destroyed for the purpose of securing the bark, which was extensively used for tanning leather. The province could once boast a large quantity of heavy birch; but of late years much of it had been converted into ton-timber and exported. Recently, too, the necessity had arisen for the somewhat extensive use of a number of portable sawmills. A large proportion of the area of the province was held by agriculturists, who hitherto appeared to have taken but little interest in the preservation of the forests, most of them having stripped more land of its timber than was actually necessary, and had not been so careful of the remainder as they should have been. As was well known, forest fires had done an immense amount of damage in the province, and large tracts of country once covered with a stately growth of pine, spruce, &c., were now almost barren. The Deputy-commissioner concluded by expressing a regret that the lumbering and agricultural portions of the population were not more fully alive to the importance and necessity of preserving the forests of the country; for, had proper care been taken to prevent fires and to guard the growing timber, the forests would be in a much more thriving state than they were at the present time.

The Report of the ex-deputy-commissioner of Crown Lands was of a more lengthy and detailed description. It started with the admission, that the greater part of the continent of North America—which a few generations ago was an unbroken forest from ocean to ocean—was being rapidly depleted of its timber; and the reader

was reminded that many sections of the Old World now sterile were prosperous and fertile before the destruction of their forests. The Report went on to account for the origin of forest fires. It appears that the aborigines, as well as the early French settlers on the continent, were careful never to make fires in the woods in the dry season of summer. In 1783, however, a great number of refugees and discharged soldiers came into the country, and many new settlements were formed. The following year, no rain fell during the latter part of May, the whole of June, and the first ten days of July. Fires were kindled in the clearings by the new settlers, and it was reported that, within a fortnight, two-thirds of the province was burned over. The ex-commissioner stated that, except what was cultivated and what was under water, every part of the peninsula of Nova Scotia would now be covered with trees, were it not for their destruction by fires, which scourged the country more or less every year; and he went on to make a suggestion with which it is impossible not to sympathise. He proposed that active measures should be adopted to put a stop to the ravages of fires, and to prevent the felling of trees of less than a given diameter—to be arrived at after due inquiry and consideration—and he ventured to express the opinion that were this done, Nova Scotia would continue to be a timber-producing and exporting country for all time to come. The necessity for some such restrictions as the ex-commissioner suggests will be quite apparent when we mention that at the present time a man is allowed to cut how and what he pleases in the forests of Nova Scotia. Sawmills of every form and variety are to be found there wherever there is a stream large enough to turn a wheel, if but for a few months in the year; and trees of seven inches diameter and upwards are cut down; those not large enough to come under the head of small deal, being made into staves, laths, and shingles. The Report concluded with the assertion, that though the yield of timber at the present time in the province was great, it would be gradually diminished unless adequate protection were afforded to trees.

Passing over New Brunswick—with reference to which province there is little information to hand bearing upon the condition of the forests—we come to Quebec. From a 'Memorandum on the Crown Timber Forests of the Province of Quebec and on the subjects submitted to the American Forestry Congress at Montreal, in August 1882, that might be applicable thereto,' many facts and figures are obtainable. The Memorandum states that the district south of the St Lawrence is generally suitable for cultivation, and is largely so employed; while the district on the north side of the river, though about one hundred and seventy-seven thousand eight hundred square miles in extent, does not contain a portion of land fit for cultivation equal to one-fourth of its area. Even that small proportion of land which is fit for cultivation, from coldness of climate in the northern part and from difficulty of access, would long be too far below the ordinary standard of agricultural value to attract settlement or admit of cultivation being profitable, were it not for the produce market and the employment afforded by the timber trade. To be permanent, this trade, according to the Memorandum, must be carried on with that ever-increasing regard for the preservation of the forests which it is evident the interests of the settlers, the public revenue, and the country generally will in future require. Being fit for nothing else, by far the greatest portion of the vast northern region referred to above must remain a forest for ever, increasing in value as timber becomes more scarce elsewhere. Perhaps, however, it will be capable of maintaining a sparse but hardy population in comparative comfort by the development of the resources of its mines and its forests, if cared for and preserved. It is said that the valuable timber of the forests is being rapidly destroyed by the commercial demand for it and by desolating fires, and it is necessary now distinctly to bear in mind that there are no new fields to fall back upon for the white pine that gives the trade its special value. The increasing scarcity of wood for fencing, building, and especially for fuel, is augmenting the difficulty of living, and consequently diminishing the value of farms even on situations otherwise favourable.

Speaking of the Forestry Association—a body of practical and scientific men—the Memorandum says that the population of the province owes it a debt of gratitude, on account of the great care it shows in dealing with the subjects of forest preservation and cultivation, so specially important to the future prosperity of Quebec. This province is obviously adapted, by its favourable geographical position and the unfitness of much of it for other cultivation, to be a timber-yielding and timber-trading country for ever.

The Memorandum then went on to quote a paper of Dr Hough, the chief of the Forestry Branch of the Department of Agriculture of the United States, advocating the planting of trees along railway lines. It contained information on the great and rapidly increasing consumption of small trees for railway 'ties' in the United States, and stated that the demand for them on the Canadian railroads must continue to increase. From two thousand two hundred to three thousand five hundred such 'ties' were used to every mile; and there were one hundred thousand miles of railroad in the United States. The average duration of a tie was five to eight years; and thirty to fifty millions would be required for the one hundred thousand miles each year. This would necessitate the annual cutting over of from sixty to one hundred thousand acres of wood; and as the trees would require on an average thirty years to attain the necessary size, there should be from about eighteen to thirty acres of woodland to every mile of the railroad. The Memorandum went on to state that amongst the trees recommended for planting along the sides of railways, the black walnut for many reasons was strongly advocated by several eminent American and Canadian gentlemen. Among the latter could be mentioned the Honourable Mr Joly, who had set a good example by commencing the cultivation of the black walnut on a large scale. It was stated, indeed, that he had recently planted ten thousand such trees in one season. This gentleman

had said, 'both the preservation of our existing forests and the creation of new forests in regions where they do not exist, are absolutely necessary.' Mr Joly had also warmly advocated the institution of an annual 'arbor-day,' or day on which the general planting of trees throughout the province would be encouraged.

The Honourable Mr Loring, the President of the Forestry Association, had formed an estimate of the time it would take to exhaust the timber-grounds in the several States of the Union, and had drawn this conclusion: in the course of one generation, the present forests of the United States would be almost entirely exhausted. This, as the Memorandum pointed out, might be regarded as painfully instructive for the population of Canada, as foreshadowing to them the exhausting demand which, long before the close of that term, would be made upon their forests to meet the requirements of the American market.

Mr P. White, M.P. for Renfrew, Ontario, in a clear, vigorous, and succinct verbal address on the loss in the province from forest fires, had estimated the value lost annually by them in the Ottawa District at twenty millions of dollars. This estimate, the Memorandum continued, might be thought excessive; though, when one bore in mind that in addition to the value of the marketable timber, the fire destroyed not only the smaller trees—that would in future years yield successive cuts of equal value—but also, in many cases, all the seedlings and seed-cones, it was impossible not to conclude that the case was, if anything, understated. As an appropriate setting off to this statement, the Memorandum said that the thinning-out of the larger trees by the lumber-man hastened the growth of the younger ones which were to succeed them. Speaking of the endeavours of the lumber-men to prevent fires, Mr White had justly remarked that the authority of government was necessary, and he had said that the trade would not object to a special tax to meet the expenses of governmental supervision. He had further suggested that the period during which the burning of brush by settlers be interdicted should be extended to the months of June, September, and October.

At the Forestry Congress held at Montreal in August 1882, a Committee had been appointed, and this Committee, in its Report, had recommended: (1) The reservation of all pine and spruce lands unfit for settlement, for lumbering purposes exclusively; (2) the prohibition of the burning of brush by settlers in the vicinity of fir-trees during the months of May, June, September, and October (July and August burning being already interdicted in the province of Quebec); (3) the division of the timber-country into districts, and the appointment of police under a superintendent with magisterial powers, whose duty it should be to detect and punish offenders and provide for the extinction of fires; (4) and that the cost of the maintenance of this protection-tax might be partially met by the imposition of a moderate tax on the parties owning or leasing timber-lands.

The Reports for the remaining provinces—Ontario, Manitoba, and British Columbia—present little that differs from the Reports to which we have already referred. The Report from Ontario came from the Clerk of Forest Preservation, who said that there existed no data by which to form an exact idea as to how long it would take, at the present rate of consumption, to exhaust the timber of those lands. He pointed out that of course everything would depend upon the measure of care that was taken in the future for the preservation of the forests. These measures would probably include the regular maintenance of officials charged with the duty of preventing the occurrence of fires. It was the Clerk's opinion that if care was taken of the remaining forests of Canada, a very large portion of them would continue in a perpetually reproductive condition, capable of furnishing an annual yield equal to that of the present year.

The Minister of Agriculture of Manitoba said that, during the rapid construction of the main line of the Canadian Pacific Railway in 1882 and 1883, large quantities of timber were used; but as that line had now reached the Rocky Mountains, the progress of construction was necessarily slower, and much less timber was required. The Department had adopted means to prevent as far as possible the destruction of timber by fire, and was endeavouring to secure the rigid enforcement of the Prevention of Fires Act. Steps had also been taken for the establishment of an annual 'arbor-day.'

From British Columbia came an energetic refutation of the assertion that the forests there were within six years of exhaustion.

The broad inferences which will be unhesitatingly drawn from the facts given above are, that provision must be made by law for the protection of the Canadian forests, both against the devastations of fire and the injudicious operations of the woodman; and it is to be hoped that the action of the government in setting on foot the exhaustive inquiries which have afforded the material for this paper, is an earnest of their intentions to place upon the statute-book whatever measures the necessities of the case may call for.

A HOUSE DIVIDED AGAINST ITSELF.

CHAPTER XXXIV.

AFTER this, for about a fortnight, Captain Gaunt was very often visible in Eaton Square. He dined next evening with Lady Markham and Frances; Sir Thomas, who scarcely counted, he was so often there, being the other *convive*. Sir Thomas was a man who had a great devotion for Lady Markham, and a very distant link of cousinship, which, or something in themselves which made that impossible, had silenced any remark of gossip, much less scandal, upon their friendship. He came in to luncheon whenever it pleased him; he dined there—when he was not dining anywhere else. But as both he and Lady Markham had many engagements, this was not too often the case, though there was rarely an evening, if the ladies were at home, when Sir Thomas did not 'look in.' His intimacy was like that of a brother in the cheerful easy house. The cheerful company, the friendliness, the soothing atmosphere of feminine sympathy around him; and underneath all the foolish hope, more sweet

than anything else, that a certain relenting on the part of Constance must be underneath, took away the gloom and dejection, in great part at least, from the young soldier's looks. He exerted himself to please the people who were so kind to him, and his melancholy smile had begun to brighten into something more natural. Frances for her part thought him a very delightful addition to the party. She looked at him across the table almost with the pride which a sister might have felt when he made a good appearance and did himself credit. He seemed to belong to her more or less, to reflect upon her the credit which he gained. It showed that her friends after all were worth thinking of, that they were not unworthy of the admiration she had for them, that they were able to hold their own in what the people here called Society and the world. She raised her little animated face to young Gaunt, was the first to see what he meant, unconsciously interpreted or explained for him when he was hazy, and beamed with delight when Lady Markham was interested and amused. Poor Frances was not always quite clever enough to see, when it happened that the two elders were amused by the man himself, rather than by what he said, and her gratification was great in his success. She herself had never aspired to success in her own person; but it was a great pleasure to her that the little community at Bordighera should be vindicated and put in the best light. 'They will never be able to say to me *now* that we had no society, that we saw nobody,' Frances said to herself, attributing, however, a far greater brilliancy to poor George than he ever possessed. He fell back into melancholy, however, when the ladies left, and Sir Thomas found him dull. He had very little to say about Waring, on whose behalf the benevolent baronet was so much interested.

'Do you think he shows any inclination towards home?' Sir Thomas asked.

'I am sure,' young Gaunt answered with a solemn face, 'that there is nothing there that can satisfy such a creature as that.'

'He has no society, then?' asked Sir Thomas.

'Oh, society! it is like the poem,' said the young man with a sigh. 'I should think it would be so everywhere. Ye common people of the sky, what are ye when your queen is nigh?'

Sir Thomas had been much puzzled by the application to Waring, as he supposed, of the phrase, 'such a creature as that;' but now he perceived, with a compassionate shake of his head, what the poor young fellow meant. Con had been at her tricks again! He said with the pitying look which such a question warranted: 'I suppose you are very fond of poetry?'

'No,' said the young soldier, astonished, looking at him suddenly. 'O no.—I am afraid I am very ignorant; but sometimes it expresses what nothing else can express. Don't you think so?'

'I think perhaps it is time to join the ladies,' Sir Thomas said. He was sorry for the boy, though a little contemptuous too; but then he himself had known Con and her tricks from her cradle, and those of many another, and he was hardened. He thought their mothers had been far more attractive women.

Was it the same art which made Frances look up with that bright look of welcome, and almost affectionate interest, when they returned to the drawing-room? Sir Thomas liked her so much, that he hoped it was not one of their tricks, then paused, and said to himself that it would be better if it were so, and not that the girl had really taken a fancy to this young fellow, whose heart and head were both full of another, and who, even without that, would evidently be a very poor thing for Lady Markham's daughter. Sir Thomas was so far unjust to Frances, that he concluded it must be one of her tricks, when he recollected how complacent she had been to Claude Ramsay, finding places for him where he could sit out of the draught. They were all like that, he said to himself; but concluded, that as one nail drives out another, a second 'affair,' if he could be drawn into it, might cure the victim. This rapid *résumé* of all the circumstances present and future is a thing which may well take place in an experienced mind in the moment of entering a room in which there are materials for the development of a new chapter in the social drama. The conclusion he came to led him to the side of Lady Markham, who was writing the address upon one of her many notes. 'It is to Nelly Winterbourn,' she explained, 'to inquire—— You know they have dragged that poor sufferer up to town, to be near the best advice; and he is lying more dead than alive.'

'Perhaps it is not very benevolent, so far as he is concerned; but I hope he'll linger a long time,' said Sir Thomas.

'Oh, so do I! These imbroglios may go on for a long time and do nobody any harm. But when a horrible crisis comes, and one feels that they must be cleared up!' It was evident that in this Lady Markham was not specially considering the sufferings of poor Mr Winterbourn.

'What does Markham say?' Sir Thomas asked.

'Say! He does not say anything. He shuffles—you know the way he has. He never could stand still upon both of his feet.'

'And you can't guess what he means to do?'

'I think—— But who can tell? even with one whom I know so intimately as Markham. I don't say even in my son, for that does not tell for very much.'

'Nothing at all,' said the social philosopher.

'Oh, a little, sometimes. I believe to a certain extent in a kind of magnetic sympathy. You don't, I know. I think, then, so far as I can make out, that Markham would rather do nothing at all. He likes the *status quo* well enough. But then he is only one; and the other—one cannot tell how she might feel.'

'Nelly is the unknown quantity,' said Sir Thomas; and then Lady Markham sent away, by the hands of the footman, her anxious affectionate little billet 'to inquire.'

Meanwhile, young Gaunt sat down by Frances. On the table near them there was a glorious show of crimson, the great dazzling red anemones, the last of the season, which Mrs Gaunt had sent. It had been very difficult to find them so late on, he told her; they had hunted into the coolest corners where the spring flowers lingered the longest, his mother quite anxious

about it, climbing into the little valleys among the hills. 'For you know what you are to my mother,' he said with a smile, and then a sigh. Mrs Gaunt had often made disparaging comparisons—comparisons how utterly out of the question! He allowed to himself that this candid countenance, so open and simple, and so full of sympathy, had a charm—more than he could have believed; but yet to make a comparison between this sister and the other! Nevertheless, it was very consolatory, after the effort he had made at dinner, to lay himself back in the soft low chair, with his long limbs stretched out, and talk or be talked to, no longer with any effort, with a softening tenderness towards the mother who loved Frances, but with whom he had had many scenes before he left her, in frantic defence of the woman who had broken his heart.

'Mrs Gaunt was always so kind to me,' Frances said gratefully, a little moisture starting into her eyes. 'At the Durants, there seemed always a little comparison with Tasie; but with your mother, there was no comparison.'

'A comparison with Tasie!' He laughed in spite of himself. 'Nothing can be so foolish as these comparisons,' he added, not thinking of Tasie.

'Yes, she was older,' said Frances. 'She had a right to be more clever. But it was always delightful at the bungalow.—Does my father go there often now?'

'Did he ever go often?'

'N-no,' said Frances, hesitating; 'but sometimes in the evening. I hope Constance makes him go out. I used to have to worry him, and often get scolded. No, not scolded—that was not his way; but sent off with a sharp word. And then he would relent, and come out.'

'I have not seen very much of Mr Waring,' Gaunt said.

'Then what does Constance do? Oh, it must be such a change for her! I could not have imagined such a change. I can't help thinking sometimes it is a great pity that I, who was not used to it, nor adapted for it, should have all this—and Constance, who likes it, who suits it, should be—banished; for it must be a sort of banishment for her, don't you think?'

'I—suppose so.—Yes, there could be no surroundings too bright for her,' he said dreamily. He seemed to see her notwithstanding walking with him up into the glades of the olive gardens, with her face so bright. Surely she had not felt her banishment then! Or was it only that the amusement of breaking his heart made up for it, for the moment, as his mother said?'

'Fancy,' said Frances; 'I am going to court on Monday—I—in a train and feathers. What would they all say? But all the time I am feeling like the daw in the peacock's plumes. They seem to belong to Constance. She would wear them as if she were a queen herself. She would not perhaps object to be stared at; and she would be admired.'

'O yes!'

'She was, they say, when she was presented, so much admired. She might have been a maid of honour; but mamma would not. And I, a poor little brown sparrow, in all the fine feathers—I feel inclined to call out: "I am only Frances." But that is not needed, is it? when any one looks at me'—she said with a laugh. She had met with nobody with whom she could be confidential among all her new acquaintances. And George Gaunt was a new acquaintance too, if she had but remembered; but there was in him something which she had been used to, something with which she was familiar, a breath of her former life—and that acquaintance with his name and all about him which makes one feel like an old friend. She had expected for so many years to see him, that it appeared to her imagination as if she had known him all these years—as if there was scarcely any one with whom she was so familiar in the world.

He looked at her attentively as she spoke, a little touched, a little charmed by this instinctive delicate familiarity, in which he at last, having so lately come out of the hands of a true operator, saw, whatever Sir Thomas might think, that it was not one of their tricks. She did not want any compliment from him, even had he been capable of giving it. She was as sincere as the day, as little troubled about her inferiority as she was convinced of it—the laugh with which she spoke had in it a genuine tone of innocent youthful mirth, such as had not been heard in that house for long. The exhilarating ring of it, so spontaneous, so gay, reached Lady Markham and Sir Thomas in their colloquy, and roused them. Frances herself had never laughed like that before. Her mother gave a glance towards her, smiling. 'The little thing has found her own character in the sight of her old friend,' she said; and then rounded her little epigram with a sigh.

'The young fellow ought to think much of himself to have two of them taking that trouble.'

'Don't talk nonsense,' said Lady Markham. 'Do you think she is taking trouble? She does not understand what it means.'

'Do any of them not understand what it means?' asked Sir Thomas. He had a large experience in society, and thought he knew. But he had little experience out of society, and so, perhaps, did not. There are some points in which a woman's understanding is the best.

The evening had not been unpleasant to any one, not even, perhaps, to the lovelorn, when Markham appeared, coming back from his dinner-party, a signal to the other gentlemen that it was time for them to disappear from theirs. He gave his mother the last news of Winterbourn; and he told Sir Thomas that a division was expected, and that he ought to be in the house. 'The poor sufferer' was sinking slowly, Markham said. It was quite impossible now to think of the operation which might perhaps have saved him three months since. His sister was with Nelly, who had neither mother nor sister of her own; and the long-expected event was thus to come off decorously with all the proper accessories. It was a very important matter for two at least of the speakers; but this was how they talked of it, hiding, perhaps, the anxiety within. Then Markham turned to the other group.

'Have you got all the feathers and the furbelows ready?' he said. 'Do you think there

will be any of you visible through them, little Fan?'

'Don't frighten the child, Markham. She will do very well. She can be as steady as a little rock, and in that case it doesn't matter that she is not tall.'

'Oh, tall—as if that were necessary!—You are not tall yourself, our mother; but you are a very majestic person when you are in your war-paint.'

'There's the Queen herself, for that matter,' said Sir Thomas. 'See her in a procession, and she might be six feet. I feel a mouse before her.' He had held once some post about the court, and had a right to speak.

'Let us hope Fan will look majestic too. You should, to carry off the effect I shall produce. In ordinary life,' said Markham, 'I don't flatter myself that I am an Adonis; but you should see me screwed up into a uniform. —No, I'm not in the army, Fan.—What is my uniform, mother, to please her? A Deputy Lieutenant, or something of that sort.—I hope you are a great deal the wiser, Fan.'

'People always look well in uniform,' said Frances, looking at him somewhat doubtfully, on which Markham broke forth into his chuckle. 'Wait till you see me, my little dear. Wait till the little boys see me on the line of route. They are the true tests of personal attraction. —Are you coming, Gaunt? Do you feel inclined to give those fellows their revenge?'

Markham had spoken rather low, and at some distance from his mother; but the word caught her quick ear.

'Revenge? What do you mean by revenge? Who is going to be revenged?' she cried.

'Nobody is going to fight a duel, if that is what you mean,' said Markham, quietly turning round. 'Gaunt has, for as simple as he stands, beaten me at billiards: and I can't stand under the affront.—Didn't you lick me, Gaunt?'

'It was an accident,' said Gaunt. 'If that is all, you are very welcome to your revenge.'

'Listen to his modesty, which, by-the-bye, shows a little want of tact; for am I the man to be beaten by an accident?' said Markham, with his chuckle of self-ridicule.—'Come along, Gaunt.'

Lady Markham detained Sir Thomas with a look as he rose to accompany them. She gave Captain Gaunt her hand, and a gracious, almost anxious smile. 'Markham is noted for bad hours,' she said. 'You are not very strong, and you must not let him beguile you into his evil ways.' She rose too, and took Sir Thomas by the arm as the young man went away. 'Did you hear what he said? Do you think it was only billiards he meant? My heart quakes for that poor boy and the poor people he belongs to. Don't you think you could go after them and see what they are about?'

'I will do anything you please. But what good could I do?' said Sir Thomas. 'Markham would not put up with any interference from me; nor the other young fellow either, for that matter.'

'But if you were there, if they saw you about, it would restrain them; oh, you have always been such a true friend. If you were but there.'

'There. Where?' There came before the practical mind of Sir Thomas a vision of himself at his sober age dragged into he knew not what nocturnal haunts, like an elderly spectre, jeered at by the pleasure-makers. 'I will do anything to please you,' he said helplessly. 'But what can I do? It would be of no use. You know yourself that interference never does any good.'

Frances stood by aghast, listening to this conversation. What did it mean? Of what was her mother afraid? Presently, Lady Markham took her seat again with a return to her usual smiling calm. 'You are right, and I am wrong,' she said. 'Of course, we can do nothing. Perhaps, as you say, there is no real reason for anxiety.' (Frances observed, however, that Sir Thomas had not said this.) 'It is because the boy is not well off, and his people are not well off—old soldiers, with their pensions and their savings. That is what makes me fear.'

'Oh, if that is the case, you need have the less alarm. Where there's not much to lose, the risks are lessened,' Sir Thomas said calmly.

When he too was gone, Frances crept close to her mother. She knelt down beside the chair on which Lady Markham sat, grave and pale, with agitation in her face. 'Mother,' she whispered, taking her hand and pressing her cheek against it, 'Markham is so kind—he never would do poor George any harm.'

'Oh, my dear,' cried Lady Markham, 'how can you tell? Markham is not a man to be read off like a book. He is very kind—which does not hinder him from being cruel too. He means no harm, perhaps; but when the harm is done, what does it matter whether he meant it or not? And as for the risks being lessened because your friend is poor, that only means that he is despatched all the sooner. Markham is like a man with a fever; he has his fits of play, and one of them is on him now.'

'Do you mean—gambling?' said Frances, growing pale too. She did not know very well what gambling was, but it was ruin, she had always heard.

'Don't let us talk of it,' said Lady Markham. 'We can do no good; and to distress ourselves for what we cannot prevent, is the worst policy in the world, everybody says.—You had better go to bed, dear child; I have some letters to write.'

(To be continued.)

ARTIFICIAL HANDS.

THE loss of a limb may be considered one of the major physical afflictions. It is also, unfortunately, one of the commonest. Were all the people who lack one or more limbs, in England alone, to be brought together, what a melancholy concourse would there be! The causes of such calamities are so various as to be practically innumerable; but we all know, in a round way, that the bulk of them are the result of accidents by road and rail, by machinery, by operations in mining, or by other dangerous occupations. Those accustomed to travel much, must often have been struck by the number of 'winged' men employed at the different railway stations throughout the kingdom in light or menial capacities; men who, having suffered in the discharge

of their duties, have been generously retained in the service of the Company. And again, the observant traveller will remark how much more frequently one-legged or one-armed men are to be met with in the streets of a Yorkshire or Lancashire town than in any town of similar size outside the manufacturing districts.

With a limb, as with an eye—once gone, gone for ever. But science can do much for the patient who is able to pay for her services. The making of artificial limbs has, in fact, become a fine art, and what is more, a by no means inconsiderable industry. Every surgical-instrument maker provides these, if not actually a manufacturer, and all of them retain men for altering or repairing. With the exception, perhaps, of one or two of the largest firms, few have the work entirely done on the premises, the greater portion being done by artists working at their own homes, and receiving their orders from various employers in the 'trade.' The best workmen are said to be found in London. One curious fact is, that this unique handicraft is often hereditary, being handed down from father to son for many generations. It is curious also that, like the toymakers of Switzerland, the whole of the members of a family are often engaged in producing artificial limbs.

Much exquisite workmanship is exhibited in the making of a 'leg' of the more expensive sort. The craft has derived its knowledge, of course, from the surgery, so that the study of a 'foot' is a study in anatomy. The limbs are turned on statuesque lines; but were that all, the art would scarcely be higher than that of the Italian image-maker. The action of the knee and the movements of the numerous joints in the foot are simulated by the skilful use of finely tempered elastic cords. The movements of the natural joints are reproduced so faithfully, that a very inappreciable halt, indeed, is all that can be observed in the gait of the wearer of a high-class artificial leg.

But our concern at present is rather with artificial arms than with these highly scientific substitutes for nether limbs. Imitation arms are also constructed on the lines laid down by anatomy, and are often very finely executed pieces of work. But strange as it may sound at first, a moment's reflection will show that they are practically valueless—are, in fact, mere dummies, like a false eye. The mechanism of a foot and leg is called upon to perform limited operations, but the operations demanded of the hand are almost infinite; and, however perfectly the wrist and finger joints may be imitated, they remain utterly inert, unless supplied with, and directed by a continuous impulse from without. In short, a hand of the kind cannot perform any useful movement unless under the guidance of a natural hand. Opening and closing the fingers is all that can be effected by simple pressure against another object; and no art can conceal from the observer the fact that the limb is an inanimate counterfeit; whilst most people would prefer the sight of an empty sleeve, as being less ungraceful than so obtrusive a make-believe.

A serviceable substitute for an arm and hand must, therefore, be sought for on other than an anatomical basis. We have seen some very handsome and ingenious contrivances to meet the case. The finer and more curious the mechanism, however, the less attainable have they been to a moderate purse, and, what is perhaps of as much importance, the less likely have they appeared to stand the every-day tear and wear of free usage. It would serve no purpose to describe them, as the majority of the class we are writing about require an article that is simple in itself, strong, durable, and reasonably priced. The demands of this class are at present met by an apparatus which appears to be the ultimate outcome of the thought and experience of everybody interested in the subject. It consists of a sheath, or 'socket,' as it is technically called, made of layers of canvas and leather, and lined with flannel or other warm fabric, into which the stump of the severed forearm is to be inserted, and the weight of which is distributed by means of straps passing through a band on the upper arm and thence, crossways, round the chest. A hollow screw, or a catch-spring, is let into the end of this 'socket,' by means of which any one of a number of 'tools' can at will be attached, and with which the owner can subserve the more common purposes of daily life. These tools, like the 'socket' itself, are generally of a stereotyped character—namely, a hook, a knife, a fork, a spoon, a pen, a pencil, and a glass-holder. A set —'socket' and tools—can be bought for from four guineas upwards, according to the quality of the materials and the class of workmanship.

Let us be thankful for what mechanical skill has thus far done to meet the case. But it is only because we doubt the finality of the resources in this direction, that we venture to point out, first, that the fixing and unfixing of the 'tools' implies the full use of one natural hand; and, secondly, that any one-handed man can perform almost all the duties allotted to the 'tools' much more readily and deftly without than with their assistance. The hook—for lifting, gathering, or carrying—is the only article of real solid utility to him, if we except, perhaps, the knife or the fork in assisting him at meals. In the case of a person who has lost *both* hands, the apparatus is, of course, more valuable. But there, again, the inherent weakness of the arrangement crops up; for the patient has to be indebted to a second person every time a 'tool' requires to be attached or withdrawn; the consequence being, that recourse to them is rare, and the all-useful 'hook' is the instrument mainly relied upon by the no-handed as by the one-handed man.

Happily, the number of instances of the loss of both hands is comparatively small. It is large enough, however, to warrant more attention than surgical-instrument makers have hitherto given it. The following case, and the apparatus designed for the patient's use, are given, in the modest hope that it may afford more than a hint for the guidance of the benevolent who are interested in any similar case, and some ray of comfort to the objects of their commiseration.

We were recently driving with a friend along one of the fine pieces of road so common in South Lincolnshire, when we passed a number of cattle being driven along by a tidily dressed, active little man by the aid of a stick and a wiry little collie. His left sleeve was empty,

and we noticed that he had also lost an eye. We made some remark upon his skill in droving, seeing that he had only the use of one hand and one eye.

'One hand!' said our friend; 'Old Lettie has *no* hands.'

'No hands! How, then, can he carry a cane and make such clever use of it?'

'Well, I will tell you the history of the case; and, in the course of the day, we may meet the man himself at Long-Sutton. His eye he lost early in life; and one day some five years ago, Lettie was employed feeding a chaff-cutter for one of the farmers about here, when his left arm was drawn in by the knives, and was torn to pieces. Instead of shouting to his mate to stop the machine, he stupidly tried to release the arm with his right hand, and that, too, was completely destroyed before he was released. His mate applied what are called fuzz-balls to the bleeding stumps; got a cart, and drove him to Wisbech hospital, some six miles distant, where the left arm was promptly removed at the shoulder, and the right hand taken out at the wrist. The man is of a cheery nature, has a fine constitution, and pulled through so well, that he was at home again in less than six weeks—but helpless. His friend, the village shoemaker, made him a rough sheath for his stump, and the blacksmith made for him a hook, which he got fixed on to the sheath; and for about eighteen months this primitive arrangement was all Lettie had to depend upon in lieu of his hands. When at home, he had to be fed like a child; and when from home, had to go without. The only work he could do was to drive a few cattle to market for the farmers. This entailed all-day absences, and the only refreshment he could get was from a beer-mug held to his head by some sociable acquaintance or other. His calling was also a very dangerous one for one so situated. Not having the use of a stick, he had to throw himself against the cattle to keep them together and get them forward. Many kind people wished to get him some appliance that might assist him; nor did money stand in the way. But the "trade" could suggest nothing except a sort of sheath for the arm, to which another person might attach a knife or a fork or a spoon when he required its use. This, his friends concluded, would have been sheer waste of money in Lettie's case; and so the subject was dropped by all except one of my neighbours, who had a strong opinion that the trade did not know everything, and that something useful could and should be designed for the poor fellow. My neighbour had no mechanical skill, but was intelligent and in earnest; and after a few days' thought, produced a design so simple and natural, that a good many wondered it had not occurred to them before. Strange to say, though, the surgical-instrument makers pooh-poohed it, said it would never answer, and in fine would have nothing to do with it. Not to be beaten, my neighbour took his design to a respectable firm in Liverpool, and talked the chief into setting about having the apparatus constructed. And Lettie has now had the article in daily use for over three years. There is nothing very clever about it or about its inception, but it has the merit of being a real practical assistant and friend to the poor fellow.'

On the afternoon of the same day, when we and our friend Mr Bateman were seated in the smoke-room of the *Bull* at Long-Sutton, the maimed drover passed the window. Our friend knocked on the window and called him in. He was asked to sit down, which he did, and immediately placed his cane between his knees, pulled it free from his arm, and began to mop his forehead with the sleeve of his coat.

'Will you have something to eat, Lettie?' asked Bateman.

'Thank ye, sir; if ye please.'

A plate of meat and bread was placed before him, and we became curious to see how he would manage. He first pushed back his sleeve against his knee, disclosing a leathern socket covered with a number of electro-plated pieces; and placing the front of the wrist against a small hook fixed in his waistcoat, pulled open a handsome knife-blade, the point of which was pronged like a fork. With this he very adroitly cut and picked up the food before him; having done which, he carefully wiped the blade, and closed it by pressing it against the table, as one would close a clasp-knife. After sundry questions about the market, Bateman laid a shilling before Lettie and asked him to put it in his pocket. Lettie smiled—this had not been the first shilling he had earned by exhibiting the resources of his stump—and in the same way that he had opened the knife, opened out what is called a catch-and-hold spring. After a little manœuvring, he contrived to fix the shilling, slid it into his pocket, and closed this blade as he had done the former. He then pressed the end of his stick into a tube lying along the back of the wrist—and which we learned contained a strong spring—the stick being held as in a vice. Before he left, we asked and obtained a careful view of the appliances, and herewith briefly note the different parts and their uses.

The 'socket' had been made exceptionally strong, and had been fitted on to a plaster-of-Paris cast taken of the man's forearm. The tube with spring is riveted along the outer side of the socket, and is about three-quarters in diameter and five inches long. The man has had a set of light garden tools made, the handles of which fit into this tube in the same way as his stick, and with these he is able to do all his own gardening. The knife, &c. is merely the idea of a many-bladed pocket-knife, applied. It is riveted to the inner side of the wrist, and arrangement has been made so that each blade can be separately opened, as described, without the assistance of a second person. It will occur to any one that the number of blades could be enlarged if required. The large hook is a fixture, and does not protrude from the end of the 'socket,' as is usually the case, but is riveted along the upper edge of the socket, from which it extends only the length of the *head* of the hook. This arrangement leaves room at the end of the stump for the old-fashioned hollow screw, common to most sockets; and the man can have a pen, spoon, &c. inserted when he requires such at home.

We will only add that from what we saw and heard, Lettie is making a reasonably good living, and declares himself better off now than when he had both hands. We can only hope that it is

so, and that other poor fellows similarly situated may take heart of grace from reading the story of his artificial hand, the workmanship of which is a credit to the makers.*

OBSERVATIONS ON THE SWALLOW.

THE following interesting notes on the swallow were recently communicated by an observer to the *Scotsman* newspaper.

Some years ago I had, to me, an unusual opportunity of observing the behaviour of a pair of swallows during almost the whole of two seasons and the opening of a third; and what follows is a record taken during the course of an acquaintance which I succeeded in establishing with the harmless and timid creatures.

I heard while in my room, one morning about six o'clock, a persistent chattering about the front-door. On going to see what was the matter, I found a couple of swallows (the front-door being open) fluttering in and out of a small outer lobby of about eight feet square. I shut the door of the inner lobby, and looked out to ascertain the cause of the evident excitement. I soon saw that the object of interest was the upper crank on the wire of the front-door bell, and that a little mud was fixed here and there on the crank. During the day a portion of a nest was built, and towards evening the birds left. With a view to observation and to insure quiet to the builders, I cut the bell-wire, put the front-door on the chain, and wedged it, leaving a space for entry and exit of some six inches. Next morning I found the birds very busy and their house rising rapidly. I had callers watched, and in a general way did all that I could to secure quiet for the birds.

My housekeeper had at first strong objections to the notion of a nest inside the house. However, her bark being worse than her bite, she was induced to forbear, and soon became quite proud of the whole thing, and a most interested watcher. I now tried to cultivate the acquaintance of my visitors. This I found was a matter of some difficulty. I had been careful from the first not to intrude, as I found that the sight even of my figure, as I looked from within the glazed inner-lobby door, caused alarm. Accordingly, I made my advances with care, and was soon able to pass from the inner to the outer lobby, and to move about or sit as long as I pleased within a few feet of the nest, watching the birds come and go as they built their nest or fed their young.

I would now state some observations I succeeded in making during the two seasons the swallows sojourned with me. And first, as to the nest. While the nest was building, I came to be of opinion that the female only builds the nest, although both male and female select the materials. I was able to distinguish between the birds, and so had a test. The difference in appearance and occupation of the two birds was quite marked. The female was dumpier in form and doucer in colour than the male. The note, too, of the male bird was strong and cheery; while that of the female was little heard, and had, even while building, a soothing, hushing sound, as of a mother stilling a child. The male bird, too, was less timorous than the female. Again, both birds, as I have said, went apparently in search of material for building the nest; but one, and always the same bird, left somewhat earlier than the other, and returned a little sooner. The pilot bird, the male, always, on returning from the search for mud, perched on the lintel above the door, and, till his mate began work, sat in silence and with head to the side, listening. Then he struck up a bright, cheering tune, and continued to sing while the work of building went on. By-and-by, when the builder had finished, he stopped singing, listened for a moment, and then flew away in search of more mud, followed by his mate; and so the work went on.

I have mentioned that the male was a less timorous bird than the female. I noticed this fact in the following amusing way: One morning, when the nest was pretty well built, I ventured, in the absence of the birds, to take a seat in the outer lobby, and within seven or eight feet of the nest. I sat perfectly still, waiting the return of the birds. The male came and took his usual place on the lintel. In a few seconds his mate followed, and seeing me as she swept in, turned tail with a cry of terror and flew out. I did not move, and presently she returned, only again to fly away in terror. The male, who had sat silent, and evidently astonished, now joined the female bird; and together they hung about the doorway chattering earnestly. In a short time the male bird left his mate, and, hovering about in ever-narrowing circles, came closer and closer to me in anxious examination. I still sat perfectly quiet. In the end the examination seemed satisfactory, for presently he joined the female and tried to persuade her to return to her work. She would not be persuaded, and advice being of no use, the master of the house proceeded to exercise authority. He flew about, evidently in anger, and tried to drive his mistress within doors. In the long-run he succeeded; and from that day I could move about or sit in the outer lobby as I pleased, without fear of witnessing another domestic scene.

Next, as to the hatching and rearing of the young. Each season saw two broods of three birds each. During the first season, the weather was uniformly genial, and both broods matured and flew early and strong. Of the second season the first brood was hatched under most favourable circumstances, but bad weather delayed the flight of the birds. In consequence, the second incubation began late; the weather, too, was, and continued to be, throughout of a very unfavourable character. Two of the birds were strong and well fed, the third was weak and ill fed. Every one knows the saying, 'There's a werdie in ilka nest;' and I never saw a better illustration of the words than in the case of the weak bird of the fourth brood. The two strong birds, before they were able to fly, took up positions, the one at the hinge corner of the door, the other at the opposite corner, and each, as the parent birds swept in every two or three minutes, caught the food; while the werdie trotted between the two, got therefore little to eat, was in a constant

* Mr J. W. Wood, 81 Church Street, Liverpool, as an artificial hand maker, may safely be recommended.

fret, and did not grow. Soon the parent birds, for want of house-room, and perhaps for sanitary reasons, began to roost outside. The young birds, however, returned to the nest each evening; and it was amusing to watch the little weakling hobbling to its bed lone and companionless.

> The swallows had set their *three*
> Young on the rail, and looked over the sea.

The two strong birds began to practise for flight and to hawk, and soon after their parents left, they flew south. I never saw the third bird attempt flight. One morning I missed it from its perch and from the nest, and what became of it I know not.

I may mention that a friend of mine, a devoted student of Gilbert White, and a great friend and observer of the swallow, used to visit my birds almost daily, and was a witness of the things I have stated. He had never seen a nest similarly situated, nor had he met anywhere with facts or a statement such as the above in his experience or on record. During the first season, we frequently thought of marking the birds, in case some of them, old or young, might return. I had hope, from the peculiar and thoroughly sheltered situation of the nest, that some of the birds might come again, and therefore did not care to do anything that might cause terror. I should have liked, no doubt, to ascertain whether old or young, or perhaps both, might return—and any evidence as to the return of the young birds would have been curious—but during neither of the two seasons did I take the birds and mark them. I am sorry I did not do so, as before a third season arrived, an accident happened to the nest that barred future observation. A caller during the winter failing to ring the door-bell in the usual way, jerked the piece of detached wire inside the outer lobby, rung the bell, no doubt, but broke the nest, and a portion came away. I was in hopes that the birds, on their return—for they came a third time—might have thought the shattered nest worth mending. On examining—and most carefully they did it—the fragments, they decided not to repair, and left the scene. Possibly, like other builders, and the general faithless, the mysterious was a foe with which they could not deal; or perhaps it was against all swallow lore that a nest so situated should fail. In any case, they took their departure, greatly to my sorrow, and so brought an amusing and most interesting experiment to a thoroughly unscientific conclusion.

THE MONTH:

SCIENCE AND ARTS.

THE Report of M. de Lesseps on the present state and prospects of the Panama Canal works, which has lately been issued to the shareholders in that vast undertaking, is full of interesting information. Although the original programme of proceedings has been modified to some extent, its salient features have not been departed from. The canal, it will be remembered, is to consist of an open cutting, nine metres deep, and twenty-two metres wide at the bottom, stretching from Colon, on the Atlantic side of the isthmus, to Panama, on the Pacific coast—a distance of about forty-five miles. The works include a lock at the Panama end of the canal, to prevent the tide creating too swift a current in the waterway, and an immense dam to intercept the waters of an encroaching river, and to turn them into another course.

With regard to the present position of these works, the Report tells us that 'half the effort necessary for the cutting of the canal has already been made,' and that without doubt the year 1888 will see the completion of the enterprise. The number of cubic yards of soil removed shows a steady increase, from over half a million, in January last, to something like three-quarters of a million cleared in May. The total amount of soil to be moved is estimated at over one hundred million cubic yards. The insurrection which took place in Colon and Panama in May last was not the cause of any loss to the canal Company, although one of the contractors was a sufferer to some extent. By referring to the several contracts with the Company, it will be ascertained that the total cost of constructing the canal will be twenty-eight million of pounds sterling.

The famous Boulak Museum, near Cairo, becomes richer and richer every year with a constantly increasing store of Egyptian antiquities; for its energetic director, Professor Maspero, performs periodical voyages of discovery, and comes back laden with spoils of great value. From such an expedition he has lately returned, and, as usual, it has been a fruitful one. Not only does he turn his attention to the exploration of sites of historical renown, but he penetrates into localities which are comparatively quite unknown. In such a place—named Ekhmeen—a vast necropolis was discovered about a year ago, and its tombs are now being daily examined. A limestone cliff forms the heart of this remarkable cemetery, and not only are the sepulchral chambers formed artificially here, but every natural fissure in the rock has its silent tenants. Some of these chambers contain as many as a dozen occupants. But they are not family vaults, for the inscriptions show that they contain bodies of persons in no way connected by family ties. It is indeed believed that these graves were not private dwellings of the dead, but more like hotels, for accommodation in which surviving relatives paid a rent to the proprietor, possibly a priest. If the dues remained unpaid, the dead were turned out to make room for others, many of these places giving evidence that the mummies have been subjected to continual changes of location. The date of these curious resting-places of the dead seems to extend from the time of the Pyramid builders to the latest Greek epoch. The bodies are covered with some adhesive material, with an overlying coat of stucco. This upper surface is painted with a portrait of the deceased, dressed in festal robes, but without any religious emblems or hieroglyphics. It is unfortunate that the bodies are so perishable that a touch is almost sufficient to cause them to fall into dust, but it is found possible with great care to preserve three or four out of every hundred disinterred.

Fifty years ago, there was discovered in Leicester a Roman tesselated pavement, which

has since become well known to archæologists. Its position in a dark underground cellar made it difficult of access and examination; it has now been purchased by the town-council, and the beauty of the work is fully displayed to view by removing the buildings which were above it. This pavement is quite a marvel of design and constructive skill, particularly when it is noted that the artist has made use of the most common materials. Different-coloured bricks, slate, and a white composition like limestone, cut into small pieces, form the tesseræ of this curious pavement. Its general construction, too, is remarkable. First, there is a foundation of concrete, upon which is laid a bed of pounded brick and lime; above this is a layer of white cement, upon which the tesseræ have evidently been stuck, with their rougher sides downwards. The operation seems to have been completed by pouring liquid cement over the ornamental floor, to fill up its interstices, after which the whole has been rubbed down and polished. The pavement is probably eighteen hundred years old.

The success of the Japanese Village in London, before its untimely destruction by fire, has led to the promotion of a somewhat similar scheme in the shape of an Indian Native Village Exhibition, and a Company has been formed to carry out this idea. Extensive premises have been secured in Regent Street, London, and visitors to the metropolis will shortly have the opportunity of there seeing native artificers, such as carpet-weavers, workers in brass, gold and silver smiths, ivory turners, &c., at work as in their shops in India. In addition to this display of native handicrafts, there will be jugglers and snake-charmers. Indian teas, curries, condiments, &c. will be served in a separate apartment by native attendants. Altogether, the Exhibition promises to be a very interesting one, and it should prove useful, too, in bringing us into nearer acquaintance with our fellow-subjects in a far-off land.

An artificial caoutchouc, which is said to resemble vulcanised india-rubber, but to be a better resister of the action of hot water, is described in one of the foreign technical journals. The skins of small animals, such as hares, rabbits, &c., are washed, cleared of hair, and boiled with five per cent. of crude glycerine and a little water in a Papin's digester until the whole mass is quite dissolved. As a result, a thick and tough glue is obtained, which is afterwards treated with potassium dichromate, to make it insoluble.

A new description of stair-plates has been patented by Mr F. W. Hembry, of Newgate Street, London. These plates—the use of which is to deaden noise and protect stairs from the effect of constant traffic—consist of metal gauze attached to a rubber backing. Above this wire-gauze is spread cement, which fills up all the interstices between the wires, and which, after vulcanisation, binds the whole into a compact material. The plates can be bent into shape to follow the contour of the steps to which it may be applied.

Some years ago, there was sold in the streets a little contrivance called the 'Lovers' Telegraph.' It consisted of two boxes, each furnished with a parchment bottom, and communicating with each other by a thread fastened to the middle of each parchment. If this thread were tightly stretched between the boxes, a speaker into one box was clearly heard at the other box, although the thread might be fifty feet or more in length. The theory of the contrivance is simple enough. The speaker causes the first parchment to be thrown into vibration; these vibrations act as pulls to the thread, so that the distant diaphragm is urged into similar movement, and the original sounds are given forth.

A mechanical telephone on the above principle has lately been invented by two American gentlemen, and has been exhibited in London with much success, the line-wire being five hundred yards long, and stretching from Ludgate Circus to Chancery Lane. The boxes are furnished with diaphragms made of thin slips of willow interlaced together, and varnished, as a protection from moisture. A metal plate forms the centre of this vibratile diaphragm, to which the line-wire is attached; and there is a provision for tightening the wire, should it become slack. One of the most ingenious features in this new form of telephone is the manner in which the wire is supported and made to turn round corners. This is accomplished by means of india-rubber corks fixed on wall brackets, attached to which are loops of wire. It will thus be seen that the whole arrangement is strictly mechanical. There is no electric apparatus to get out of order, and the difficulties arising from 'induction' are avoided. Each box acts as transmitter and receiver, and the system has the merit of simplicity.

The signalling balloon invented by Mr Bruce, which is shown at the Inventions Exhibition, has recently been tried for the first time in actual practice. Made of a material as translucent as possible, the balloon contains within its gas-chamber a number of incandescent electric lamps. These glow-lamps are in connection with the earth by means of wires which pass down the cord which holds the balloon captive. The current is put on to the lamps for short or long periods, so as to spell out messages from aloft by the Morse code.

A wonderful instance of the manner in which a scientific discovery can be turned to practical advantage has recently occurred. At the Montreal meeting of the British Association, Professor Lodge gave a lecture on 'Dust,' and pointed out a new observation due to himself and Mr J. W. Clark. These two gentlemen had made the curious discovery that the passage of electric sparks through a dust-laden atmosphere would quickly cause the dust to settle down. During the lecture alluded to, a bell-glass filled with magnesium smoke was subjected to experiment, and the contained air rapidly became clear when the sparks were passed through it. So much for the scientific discovery. Now for its application. The head of a firm of lead-smelters in Wales read a report of this lecture. He knew what difficulty there was in retaining the fume or volatilised lead from the smelting-works, and preventing it escaping from the flues to poison the atmosphere outside, besides robbing the smelter. He determined to see whether the electric spark would not cause the fume to fall in the same way that it acted upon dust. An experimental shaft made of barrels, with windows in it, and an electric machine by which sparks could be sent through the fume, soon demonstrated

the fact that the thing could be done. The works are now to be supplied with apparatus for treatment of the fume on a large scale, and the results will be looked forward to with great interest. It will be evident that the principle is applicable to other industries besides lead-smelting, and its adoption will be hailed with satisfaction both by manufacturers and sanitary reformers.

On a broad river near the city of Baltimore, some experiments have lately been carried out by Professor Graham Bell with reference to the prevention of collisions at sea in times of fog. These experiments are based on the well-known property of bodies placed in the path of sound-waves reflecting back those waves as an echo. As a source of sound, a musket with a speaking-trumpet at its muzzle and loaded with blank cartridge was employed. This trumpet not only gave direction to the sound-impulse, but also intensified the audible effect. It was found that ordinary steamboats and vessels with large sails threw back an echo that was most readily observable. Even a boat approaching with its bow towards the source of sound threw back a feeble echo at a distance of a quarter of a mile. A curious effect was noticed when the surface of the river was rippled, each ripple sending back a reflected wave of sound, the whole resembling a distant roll of musketry. It is believed that this new method will be of great value in indicating the position of icebergs. It need hardly be pointed out that the distance of the obstructing body can be readily calculated by observing the lapse of time between the report and the reception of its echo.

Pintsch's principle of compressing oil-gas for lamps on railways is now familiar to all travellers. It has for some time been applied to buoys at outlying places, where a light can be kept burning for many weeks or months according to the capacity of the apparatus. Eight such buoys have been in use for many months on the Suez Canal, and now four more have been sent out to the same place. A gas beacon made on this principle is to be erected in August next on the Gantoch rocks in the Clyde. The chief advantage of the system is, that a light can be kept burning without supervision for a very long period.

An outbreak of natural gas in the river Clyde, a few hundred yards below Bothwell Bridge, has lately excited much interest. It seems that the river in that place has for some time bubbled up in a curious manner; but it attracted no attention until an angler, happening to throw a cigar-light into the water, was astonished to see the bubble burst into flame. This flame rises to a height of several feet. Such outbreaks of gas are not unprecedented in Lanarkshire, more than one instance having been recorded in past years. But such displays sink altogether into insignificance when compared with the vast outpourings of natural gas in more distant parts of the world. The town of Pittsburg, Pennsylvania, for instance, is extensively lighted from subterranean sources. The supply at present is about twenty-five million cubic feet each day, and this will, it is anticipated, be increased to forty million feet when a ten-inch main now being laid is completed. The houses supplied number fifty mills and factories, besides numerous private residences.

The attention now being paid to the revival of Irish industries has no doubt stimulated the promoters of the Irish Artisans' Exhibition, recently opened in Dublin. The object of this Exhibition is to show what can be done by workmen themselves in their spare time. The scheme has in every way proved to be a success.

There is much interest attached to the many schemes which are being introduced to supersede horse-traction by some mechanical mode of propulsion. Steam tramcars are now common in many of our Northern and Midland towns, although the metropolis has for the present had nothing to do with them. Electrical tramcars have been tried, and apparently found wanting, for they have not come into anything more than experimental use. Two years ago, an air-driven car was tried in North London, and for some months did its daily journeys in competition with the horses. We now learn that these trial trips were so satisfactory in every way that the Company intend to displace the whole of their horse-worked cars on this line by ten compressed air-cars on the Mékarski system. The method has for some months been shown in operation on a short line in the grounds of the Inventions Exhibition. Its introduction will be hailed with delight by all who know what killing work the tramways are to the poor horses.

A swarm of bees settling on a man's head in Regent Street, London—a locality from which one must travel a considerable distance in any direction before green fields are reached—is an occurrence of too startling a nature to pass unnoticed. If the most daring novelist had described such an event, he would have been unmercifully ridiculed. But the truth, ever stranger than fiction, still remains, that a gentleman in Regent Street was lately seen covered from crown to waist with a large swarm of bees. After walking up and down for some time in the hope that his strange tenants would leave him, he was assisted to remove his coat and hat. The swarm then took flight, leaving behind them luckily only one or two stings.

Jordan's improved Sunshine Recorder is an instrument of great value to the meteorologist, and of interest to all, when it is considered what an important aid to human welfare in various ways is the presence of actual sunshine. The means of recording the exact amount of this life-light which is received in various districts month after month and week by week, for the sake of comparison with other phenomena, is naturally a thing of great moment. The improved instrument is very simple in construction, and cannot get out of order. It consists of a hollow cylinder, lined with a chart made of paper sensitive to light. The solar rays reach this surface through two small openings, one aperture serving for the sun's entrance during the morning hours, and the other for the afternoon. When once adjusted according to the latitude of the place of observation, the recorder requires no attention beyond a visit to replace the chart by a blank one every evening. The chemical record is rendered permanent by merely soaking the paper in water for a short time.

It is remarkable that the chief precious metals, gold, platinum, and silver, are characterised by a high degree of ductility. Professor S. P. Langley has recently obtained platinum wire

one-fifteen thousandth of an inch in diameter. This, however, is by no means the limit of attainable tenuity, as the metal may be drawn much finer if care be taken to secure perfect freedom from dust particles, which scratch the wire and lead to its rupture. Mr Read of Brooklyn, indeed, has produced a platinum thread which is so fine as to be scarcely visible to the ordinary unassisted eye. The following is his ingenious method of preparing these filaments. He covers ordinary platinum wire with an outer coat or tubing of silver; this bimetallic combination is then drawn like ordinary wire, the process being repeated until an incredible degree of tenuity is attained. When the proper stage has been reached, the silver-covered platinum wire is plunged into a bath of nitric acid, which dissolves off the envelope of silver and leaves bare the fine core-thread of platinum. Mr Read proposes to employ this fine platinum filament, instead of the spider-thread at present in use, for dividing the fields of certain optical instruments.

As it is not everybody who has the good fortune to have sun-blinds affixed to every window in his house, it may be worth while to note that a very effectual and very cheap protection from the sun's rays is within the reach of most people. It consists in simply lowering slightly the upper division of the window-frame, and turning the ordinary linen blind outside instead of inside the window. Thus the window-panes are not only shaded, but a space, through which there is necessarily a draught, is between them and the linen. The effect in cooling a room when the blaze is strong is quickly perceptible; for, as is well known, the oppressive warmth from an unshaded window is due chiefly to the accumulated heat in the glass. While the bright sun is on the blind, there will be plenty of light in the room. Should a wind shake the blind inconveniently, it can be kept still by drawing the cord and tassel into the room and securing it by shutting down the lower division of the window-sash.

At a meeting of the Scottish Meteorological Society, there has just been exhibited an anemometer (wind-measurer) devised by Professor Crum Brown of Edinburgh. Mr Dickson has for some time been making observations with it at the Marine Station, Granton. The instrument has eight cups, instead of the four used in the ordinary Robinson anemometer; and the gusts of wind, turning the shaft in a degree proportioned to their strength, record themselves by pencil on a sheet of paper wrapped round a cylinder which is driven by clockwork—thus giving the time of occurrence of the various gusts. What has yet to be done, it was stated, was to give an arithmetical value to the strength of the gusts as recorded; and it was mentioned that with that view it was intended to obtain permission to affix such an instrument to a train travelling at a known rate of speed.

The hot weather has once more brought to the front the very difficult question of sewage disposal in our large towns and cities, the metropolis and its dirty Thames naturally figuring as the moral to adorn the tale. The metropolitan authorities seem to be quite powerless to mend matters. A recent visitor to the works on the Thames tells us that nothing whatever is being done beyond a little experimental work with a toy tank. Perhaps the best suggestion for dealing with this bugbear, which becomes more difficult to deal with every year, is that of Mr Page, a Thames ship-owner—namely, that a small fleet of large tank steamers should be built to carry the daily sewage of London far out to sea, and there discharge it in deep water. Such a fleet could be built for the price of one ironclad, and its object would be to save life and not to destroy it. This proposal has, we learn, been already submitted to the Metropolitan Board of Works.

OCCASIONAL NOTES.

SIMPLE PISCICULTURE.

To stock small lakes and rivers with trout is now, owing to recent advances in the knowledge of pisciculture, an easy and by no means expensive matter. By a system of which we are about to give some useful particulars, thirty thousand trout-fry can be turned into a stream at a cost—irrespective of carriage—of less than twenty pounds. To carry out the system, experience is not absolutely necessary, provided there is sufficient intelligence to take its place.

A most difficult part of pisciculture is spawning the fish, and taking care of the ova until they become eyed, that is, until two little dots can be seen in the egg, which indicate that the embryo fish is safely inside, and will soon be ready to emerge. Constant attention, pure water, and other essentials, are necessary to bring the ova up to the eyed stage; but after that, the rest is simple. As has been previously noted in these pages, pisciculturists, and notably Sir James Maitland of Howietoun (Stirlingshire), now sell the eggs when they are about a week off hatching, for they then travel well on swan's-down, in boxes, packed between layers of moss. The one essential is to keep them cool by means of ice, otherwise they are apt to hatch out, or die on the journey. The great advantage of purchasing the ova in their eyed state is, that then the chief dangers have been got over; the ova are hardy and not easily injured, and can be hatched out almost without appliances and without difficulty. They have simply to be laid down in the bed of a stream in about six or eight inches of water, covered with fine wire-netting, to keep off water-birds, rats, and fishy foes; and, provided no heavy flood comes and sweeps them away, they hatch out in a few days, after which the fry—or alevins, as they are called for the first few weeks of their existence—shift for themselves. The foregoing is the most simple method of dealing with the ova, and owing to its simplicity, it often succeeds when more elaborate plans fail. In some streams, the water, where only six inches deep, runs a little too rapidly to allow the ova to remain on the bottom. The best plan, then, is to go to some shallow on which there is only one or two inches of water; scoop out a trough half-a-dozen inches deep; strew the bottom with small gravel stones about the size of cobnuts, and on them lay the ova, of course covering with wire-netting, as before. Some judgment is required as to the choice of a shallow, as, if the stream is too strong, it will cover

the eggs with sand and small stones; whereas if no water flows through the trough, few if any of the eggs will hatch. It is a good plan to make the trough rather larger than is wanted, and not to put any eggs within a foot of its head.

The eggs should be laid down without being touched with the hand. When the lid of the box in which they arrive from the fishery is unscrewed, they will be found in layers on swan's-down, and covered with pressed moss. The latter should be *rolled* (not lifted) off them; the swan's-down, held by each side, should be put in the water, and the eggs floated off it into the trough, or 'redd,' to use the proper term. The eggs should not lie in a heap; but it will not matter much if they touch one another. If they lie too thickly, a slight disturbance of the water over them with a feather will cause them to separate. Where the stream is naturally rather muddy, and gives considerable deposit, the eggs should only be laid down about three days before they are due to hatch, otherwise they get covered with sediment, and are thus suffocated.

Late autumn, winter, and early spring are the times during which eyed ova can be obtained. It is well to take advantage of a spell of fine dry weather for the hatching-out, floods being very troublesome and occasionally ruinous to the pisciculturist.

One thing must always be borne in mind—namely, that still water is fatal to trout-eggs. Therefore, it would be futile to sow ova in the bed of a mill-tail, for when the mill stopped work on Sunday, they would all be suffocated, by reason of the non-aeration of the water. Deep water, also, is likely to suffocate them. After the ova hatch, the little fry or alevins will be noticed to have a yellow bag about the size of a pea attached to them. This is called the yolk, or umbilical, sac, and contains the food which nourishes them for the first three or four weeks; when it has nearly disappeared, the little fish come from under the stones where they have been for some time hidden, and begin to seek food for themselves. Not the least advantage of this system of stocking is that the young fry spread over the stream and find their own food; for the greatest losses occur in piscicultural establishments during the fry period, owing to the difficulty of feeding such tiny things.

In brooks which are very subject to floods, and therefore unfit for artificial trout-breeding, the following plan can be followed: parallel to the brook, dig a long narrow trench, and make the bottom six inches below the level of the water. Run water into it at one end and out at the other by means of three-inch drain-pipes. The bottom of the trench must be covered with gravel, and in it the ova can be hatched, going, when they feel inclined, into the brook through the outlet pipe. If built properly, floods will not affect this redd, as not more than a certain amount of water can possibly enter through the inlet pipe. A redd of this kind, fourteen inches wide and fifteen feet long, will easily contain a box of fifteen thousand ova.

In stocking a lake or large river, the eyed ova should be sown in some stream connected with it. The ova of Loch Leven trout may with great advantage be used for lakes, and possibly for very large rivers. Ova of the common brown trout are best for smaller streams. It has quite recently been found out that American brook-trout do well in lakes through which no river runs; but they have not been a success in the rivers of this country.

HALF-BRED SALMON.

An interesting experiment, conducted by Dr Francis Day, at the Howietoun Fishery, in Stirlingshire, has come to an untimely end. Not very long ago, learned theorists leaned strongly to the opinion that a hybrid between salmon and trout was an impossibility; but practical men, on the other hand, were inclined to take the contrary view. Among these latter was Sir James Maitland, the owner of the Howietoun Fishery, who quickly proved his views on the subject to be correct by fertilising eggs of twenty thousand Loch Leven trout with the milt of a salmon (*Salmo salar*). These hatched on March 9, 1882, just seventy-five days after they were laid down on the 'grilles,' and for probably the first time in the history of pisciculture, a race of half-bred salmon came into existence.

From these hybrids it was hoped that a valuable kind of fish might be bred, possessing many of the excellent qualities of the salmon without its migratory habits; but whether these particular hybrids were capable or not of continuing their species, was a doubtful question, only to be solved by time. In the fry-stage, always the most trying period, there seems to have been a considerable mortality among the little fish, for on November 15, 1882, there were only about a thousand remaining, the finest specimen being four and a half inches long. In March, 1884, the hybrids were reduced to two hundred and twelve in number, but all were apparently in excellent health. They were about this time placed in an octagon pond, having a diameter of twenty feet, and a depth of five and a half feet. The largest specimen then was a little over ten inches in length; but some were not above two and a quarter inches—a remarkable difference in size, when it is remembered that the ages and parents were the same.

During the autumn of 1884 and the early spring of this year, several fish were taken out of the pond; but all were sterile. In May, however, a fish was taken out dead, which proved to be a female with eggs developing, and which, in Dr Day's opinion, would, had it lived, have bred this winter. In July, owing to the great drought, the stream which fed the pond became very low, and the pond was a good deal discoloured. One morning, the keeper, on going to feed the hybrids, saw one dead fish floating, and none rose to the surface to take the food. The water was at once drawn off, and it was discovered that, with one exception, all the fish were dead. The largest was found to be thirteen and a half inches long, and weighed over a pound.

The termination—for we cannot call it failure—of this interesting and important experiment is much to be regretted. This winter, the hybrids would probably have been crossed with themselves, and also with trout and salmon, and a valuable kind of fish might have been the

result. In a detailed account of the experiment, written by Dr Day, it is stated that there are fortunately some more of similar but younger hybrids at Howietoun, which will in due course solve the inquiry.

PROPOSED EARTHQUAKE OBSERVATIONS ON BEN NEVIS.

At a recent meeting of the Scottish Meteorological Society, Professor Ewing, Dundee, described the manner in which he proposes to conduct a series of earthquake observations on Ben Nevis. He was, he said, instigated to take up the work by three of the directors of the Society; and in setting himself to it, he had adopted a wider view of the sense of the word 'earthquake' than was colloquially attached to it. If he accepted the restricted meaning of the word, there would, he supposed, be very little observation possible on Ben Nevis; but recent observations made in various parts of the world had shown that for the earth to be really at rest was an event of the most extreme rarity, if it ever occurred at all. In the wider meaning which he proposed to give to the word 'earthquake,' they must understand at least three tolerably distinct classes of earth-movements. There were, first of all, earthquakes proper; and here he might say that he had served a pretty good apprenticeship in the observation of these, having experienced about three hundred of them during a five years' residence in Japan. Next there came a class of earth-movements of so very delicate a kind as to be totally undistinguishable without some form of instrumental assistance—earth-tremors, he called them; and last of all, there were what might be named changes of the vertical, or those tiltings which the earth's surface seemed to be constantly undergoing. Professor Ewing then described in detail the three instruments which he was having constructed for the purpose of recording earth-movements. What was wanted in the observation of earthquakes proper and of earth-tremors was an approach to neutral equilibrium; and this he had endeavoured to secure by an apparatus which was so adjusted as to combine a pendulum proper with what was in effect an inverted pendulum—the inverted pendulum being below the other, and the 'bobs' of both being connected by what is virtually a ball-and-socket arrangement. In the case of the instrument intended to record the changes from the vertical, a mirror firmly fixed in the rock is so placed in relation to a plate of mercury that when there is no tilting the images of both coincide, and are taken in by a microscope placed in a certain position. When, however, there has been any tilting, the images diverge, and the microscope at once detects the divergence, as well as the extent of it.

ANOTHER GREAT AFRICAN WATERWAY.

Since the discovery of the course of the Congo itself, no more important addition to our knowledge of the hydrography of the region has been made than that from which the Rev. G. Grenfell has recently returned. He has proved that the Mobangi, which enters the right bank of the Congo, forming a great delta, between twenty-six and forty-two minutes south latitude, nearly opposite Equator Station, is probably its greatest tributary. Certainly, so far as yet known, it offers a much longer waterway than any affluent that has been explored. Mr Grenfell navigated the Mobangi in the little steamer *Peace*, on a mean course of north by east, from the equator to four degrees thirty minutes north latitude, and left it still in an open waterway. At four degrees twenty-three minutes north, just below the second rapids, he found it six hundred and seventy-three yards wide; at no point lower was it less in width. Its mean depth is twenty-five feet, and although there the current runs not more than eighty to one hundred feet per minute, it means an immense volume of water to find running south at a point, as Mr Grenfell puts it, so near the supposed sources of the Binué, the great affluent of the Niger. Where does it all come from? he asks. The 'trumbashes' of the Chad basin (Schweinfurth) are common, while they are not known on the Congo. The opinion of Mr Grenfell and of his Congo colleagues is, that the Mobangi is probably the lower part of the Welle, a river whose course is one of the unsolved problems of African geography. A large map, in ten sheets, of the explored part of the river has just been received at the Royal Geographical Society. This map will appear in an early number of the Society's proceedings; and a long narrative of Mr Grenfell's recent work will probably be published in the next number of the *Baptist Missionary Journal*. It is hoped, moreover, that a full narrative of Mr Grenfell's explorations will reach England in time to be read at the Aberdeen meeting of the British Association.

HOW TO PRESERVE CUT FLOWERS.

An important rule, though seldom regarded, says *Popular Science News* (United States, America), is never to cram the vases with flowers. Many will last if only they have a large mass of water in the vase, and not too many stalks to feed on the water and pollute it. Vases that can hold a large quantity of water are to be preferred to the spindle-shaped trumpets that are often used. Flat dishes filled with wet sand are also useful for short-stalked or heavy-headed flowers; even partially withered blooms will revive when placed on this cool moist substance. Moss, though far prettier than sand, is to be avoided, as it so soon smells disagreeably, and always interferes with the scent of the flowers placed in it for preservation. In the case of flowers that grow only in a cool temperature, and suffer when they get into warm and dry air, all that we can do is to lessen evaporation as much as possible, and when such flowers have hairy stems and leaves, to submerge them for a minute, so that by capillary attraction they may continue to keep themselves moist and cool; but this is dangerous to table-cloths or polished surfaces, unless care be taken that the points of the leaves do not hang down, to prevent dripping. Another means of preventing delicate and sweet-scented flowers from flagging is to cut them with several leaves on the stem, and when the flower-head is placed in water, to allow only this head to remain above the water, while the leaves are entirely submerged. By this means the leaves seem to help to support the flower, which will then last for three days in a fairly

cool room. Frequent cutting of the stem is of great use; but with all flowers, by far the best plan is to put them outside, exposed to dew or rain, during the night, when they will regain strength enough to last for days. All New Holland plants, particularly flowering acacias, are benefited wonderfully by this apparent cruelty, and will even stand a slight frost far better than a hot room at night indoors.

A SAFE BENZOLINE LAMP.

A lamp has been invented on a principle which precludes the possibility of the oil escaping; and thus an explosion is made impossible. Our readers will be acquainted with the 'unspillable' ink-bottle, in which an inside channel of glass of about two-thirds the height of the vessel descends from its top, having an open and somewhat-narrowed bottom, the arrangement making it impossible, or nearly impossible, for the liquid to escape. The same principle is adopted in Smith's Patent Benzoline Lamp, from which the chances of the oil spilling are even fewer than the chances of the ink spilling. The burner screws immediately over a metal channel which descends into the body of the lamp. At the bottom of this channel there is a good-sized hole, and a little way from the bottom there are a couple of small holes. Through the larger hole a sponge is fixed, the portion in the body of the vessel underneath being greater than the portion which protrudes above. The oil is then poured into the descending channel, and finds its way beneath through the smaller holes. Two fillings of the channel represent an adequate feeding of the lamp. All that now remains to be done is to screw on the burner, the wick descending from which will rest upon the head of the sponge, and will be fed with the oil by the process of absorption. The lamp may now be dropped or otherwise upset without the possibility of the imprisoned oil coming in contact with the flame; and thus perfect immunity from explosion is secured. An interesting fact in connection with this newly patented lamp is that it is remarkably economical. The manufacturers—Messrs John Fell & Co., of Wolverhampton—assert that it will burn for fourteen hours at full flame without recharging, at the trifling cost of one halfpenny.

A NEW KETTLE.

An kettle has been invented which is entirely different in construction from the ordinary utensil in which water is boiled; and it is claimed for the novelty that it will perform its function in a considerably shorter space of time than its predecessors. The Victoria Steel Kettle, as the recent invention is called, has several points of difference from other kettles, but it possesses one prominent feature, upon which it mainly lays its claim to distinction. While the kettle is practically similar in shape to the article we are so familiar with, and is surrounded by a circular wall of an unvarying height, it needs but to be inverted for a novelty of construction immediately to manifest itself. One finds that it is seemingly hollowed out, and that the metal plate is shaped so as to form a diagonal flue, which, starting with the same circumference as the kettle itself, tapers to a small opening at the back of the utensil immediately below the handle. Thus the capacity of the vessel for carrying water is reduced by about one-third, the advantage gained being that the fire, passing through the body of the kettle, causes a quick draught, and the water is raised to the boiling-point in from four to six minutes. The heat, being to a certain extent confined, of course attains considerably more intensity than if, as is usually the case, it merely played upon the bottom of the kettle and passed off on all sides without any restraint. The price of the kettle runs from two shillings and threepence, and it is made in sizes capable of holding from one pint to a hundred gallons. The sole proprietors of the invention are the Patent Victoria Kettle Company, 7 Westminster Chambers, Victoria Street, S.W.

AT THE GATE.

We stand beside the little gate,
Hand clasping hand, my love and I;
The winds are hushed, the hour is late,
And we have met to say good-bye!
Never a solitary bird
His wing above the river dips,
As we repeat the saddest word
That ever fell from human lips.

'Mid tender sighs, 'tis breathed at last;
I seek to draw my hand away;
But oh, my darling holds it fast,
And love's fond pressure bids me stay.
Dear loving hand! so strong, so brave,
On locks of mine no more to lie,
Or deck my tresses for the grave,
As I have hoped in days gone by.

Ah, gentle hand, that never more
Shall lead me o'er each rugged rock!
At evening, on our cottage door,
How welcome was your well-known knock.
We cannot smile, my dearest, now,
Our future seems so full of care;
There is no brightness on my brow,
There is no sunlight in my hair.

Go, dearest, go, before the weak,
Fond promptings of thy breaking heart
Show through the pallor of thy cheek,
And bid the tell-tale tear-drops start.
Go, darling, go; my hand release!
'Tis duty pleads—shall we rebel?
Nay, love, be firm, and go in peace;
We part, because we love so well!

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